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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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09/866,576

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Tadahiro Ohmi

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01/30/2003

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EXAMINER

OWENS, DOUGLAS W

ART UNIT

PAPER NUMBER

2811

DATE MAILED: 01/30/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

09/866,576

Applicant(s)

OHMI ET AL.

Examiner

Douglas W Owens

Art Unit

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 14 November 2002.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1-39 is/are pending in the application.
- 4a) Of the above claim(s) 9-39 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-8 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 01 January 0921 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

## Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

## Attachment(s)

- |                                                                                              |                                                                             |
|----------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)                  | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s). _____  |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)         | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ | 6) <input type="checkbox"/> Other:                                          |

## DETAILED ACTION

### *Claim Rejections - 35 USC § 103*

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 1-5, 7 and 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over US patent No. 4,027,320 to Jacobs et al. in view of Campbell, The Science and Engineering of Microelectronic Fabrication, pages 29-31.

Regarding claim 1, Jacobs et al. teaches a semiconductor device characterized by:

a silicon substrate (1);

a silicon oxide film (4) containing krypton (Col. 2, lines 58-61).

Jacobs et al. does not explicitly teach a silicon substrate comprising (111) oriented crystals. Campbell teaches a silicon wafer formed from a boule and having a (111) orientation (Figure 2-23). It would have been obvious to one of ordinary skill in the art to select a commercially available wafer with a (111) orientation since it is commonly used in the art for p-type and n-type wafers.

Regarding claims 2 and 4, Jacobs et al. teaches a semiconductor device, wherein the silicon oxide film has a surface state density of  $10^{11} \text{ cm}^{-2}$  (Col. 2, lines 34-41).

Regarding claim 3, Jacobs et al. does not explicitly teach a device wherein the Kr concentration decreases from a surface of the silicon oxide to an interface between the oxide and the crystal. Jacobs et al. teaches a that any distribution profile is permissible which would not have precluded one wherein the Kr concentration decreases from a surface of the silicon oxide to an interface between the oxide and the crystal.

Regarding claim 5, Jacobs et al. teaches a semiconductor device further comprising a gate electrode (5) on the silicon oxide film.

Regarding claim 7, Jacobs et al. does not explicitly teach a semiconductor device wherein the crystal surface forms a principle part of the silicon substrate. Campbell teaches a crystal surface that is the principle surface of a silicon substrate. It would have been obvious to one of ordinary skill in the art to incorporate the teaching of Campbell into the device taught by Jacobs et al. for reasons discussed above.

Regarding claim 8, Jacobs et al. does not teach a semiconductor device, wherein the crystal surface is polysilicon. Campbell teaches a crystal surface comprising polysilicon (Figure 2-21). It would have been obvious to one of ordinary skill in the art to incorporate the teaching of Campbell into the device taught by Jacobs et al. for reasons discussed above.

3. Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Jacob et al. in view of Campbell, pages 29-31 as applied to claim 1 above, and further in view of Campbell, pages 394-396.

Jacob et al. does not teach a semiconductor device, wherein the crystal surface is part of a device isolation groove. Campbell teaches a trench isolation structure that is

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suitable for integrated circuits with high transistor densities. It would have been obvious to one of ordinary skill in the art to incorporate the teaching of Campbell into the device taught by Jacob et al. since it is desirable to prevent unwanted shorting between active devices on a substrate.

### ***Response to Arguments***

4. Applicant's arguments filed November 14, 2002 have been fully considered but they are not persuasive.

The applicant argues that one having ordinary skill in the art would not have been motivated to use a wafer with the crystals having orientations of (111) because of problems arising from forming a gate oxide on a substrate with (111) crystal orientations. It is common in the art to form MOS structures, which include gate oxides, on commercially available substrates having a (111) crystal orientation as evidenced in the following publications:

US Patent Application Publication No. 2002/0036320 to Ichimori et al. discloses a gate oxide formed on (111) oriented silicon;

US Patent No. 4,143,388 to Esaki et al. discloses a MOS device formed on a (111) oriented silicon substrate (Col. 4, lines 30 – 33);

US Patent No. 6,445,043 to Chittipeddi discloses that an oxide film (20) can be formed on a substrate with a (111) orientation (Col. 2, lines 44 – 46);

US patent No. 6,034,430 to Hamburger et al. discloses that (111) oriented substrates are normally commercially available in the art (Col.3, lines 38 – 40); and

Other publications of interest are US patent No. 6,420,764 to Blanchard , US patent No. 6,151,240 to Suzuki, US patent No. 6,278,138 to Suzuki and US patent No. 6,306,734 to Givargizov.

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It can be seen that substrates having a (111) crystal orientation are quite common in the art and are often used to form MOS devices. It would have been obvious for one of ordinary skill in the art to use a (111) oriented substrate with the teaching of Jacobs et al. because it is so well known in the art as further evidenced by the cited publications above.

### ***Conclusion***

5. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Douglas W Owens whose telephone number is 703-308-6167. The examiner can normally be reached on Monday-Friday.

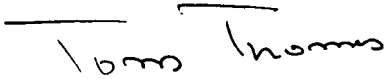
If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tom Thomas can be reached on 703-308-2772. The fax phone numbers for

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the organization where this application or proceeding is assigned are 703-308-7722 for regular communications and 703-308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

DWO  
January 24, 2003

  
TOM THOMAS  
SUPERVISOR  
TECHNOLOGY